

# PATENT ABSTRACTS OF JAPAN

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(21)Application number : 11-125445 (71)Applicant : TOYOBO CO LTD

(22)Date of filing : 06.05.1999 (72)Inventor : MINEMURA SHINICHI  
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(54) ADSORPTION SHEET, ITS PRODUCTION AND AIR PURIFYING FILTER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an adsorption sheet superior in air permeability or the like, and an air purifying filter superior in dust removing performance by providing a granular activated carbon-containing sheet containing granular activated carbon with the average particle size specified, support fibers fixed in contact with it and adhesive fibers for mainly contributing to shape holding.



SOLUTION: The granular activated carbon-containing sheet used to the adsorption sheet is formed from granular activated carbon 1 having 60-600  $\mu\text{m}$  average particle size, the support fibers fixed in contact with it and the adhesive fibers for mainly contributing to the shape holding. The support fibers and the adhesive fibers consist of a coextruding fiber component 2 at this time. The content of the granular activated carbon is higher as it goes to the lower side, and also a surface layer L1 less in the content of the granular activated carbon 1 compared to the back side layer L2 is formed on the upper side surface. The granular activated carbon-containing sheet incorporates 30-80 wt.% granular activated carbon and also the outer surface area of the support fiber is preferably set at not more than 1  $\text{m}^2/\text{g}$  and the fiber length of the support fibers at 3-20 mm and the specific gravity of the support fibers at 0.8-1.7 g/cc.

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## CLAIMS

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[Claim(s)]

[Claim 1] It is an adsorbent sheet containing the support fiber which it is the adsorbent sheet which has a granular-active-carbon content sheet, and said granular-active-carbon content sheet contacts granular active carbon with a mean particle diameter of 60-600 micrometers and its granular active carbon, and is fixed, and the adhesive fiber which mainly contributes to configuration maintenance.

[Claim 2] Said surface layer is an adsorbent sheet according to claim 1 which said granular-active-carbon content sheet consists of a surface layer and a background layer formed in the background, and has few contents of said

granular active carbon as compared with said background layer.

[Claim 3] The adsorbent sheet according to claim 1 or 2 with which said granular-active-carbon content sheet is formed in one of wet adhesion, using water bloating tendency fiber as said adhesive fiber.

[Claim 4] claims 1-3 whose fiber length the outside-surface products of said support fiber are below  $1\text{m}^2/\text{g}$ , and is 3-20mm and whose consistencies are 0.8-1.7g/cc -- an adsorbent sheet given in either.

[Claim 5] claims 1-4 in which said granular-active-carbon content sheet contains said 30 - 80% of the weight of granular active carbon to the total weight -- an adsorbent sheet given in either.

[Claim 6] claims 1-5 which said granular-active-carbon content sheet makes come to form the detailed hole which can carry out aeration substantially in the thickness direction -- either -- the adsorbent sheet of a publication.

[Claim 7] said detailed average puncturing area per hole of a hole --  $0.5\text{mm}^2$  -  $3\text{mm}^2$  it is -- adsorbent sheet according to claim 6.

[Claim 8] The adsorbent sheet according to claim 6 or 7 whose number of said detailed hole is one - 20 per said granular-active-carbon content sheet  $1\text{cm}^2$ .

[Claim 9] claims 6-8 whose numerical apertures of said detailed hole are 3% - 10% -- an adsorbent sheet given in either.

[Claim 10] said granular-active-carbon content sheet -- in addition, claims 1-9 containing a permeability sheet -- an adsorbent sheet given in either.

[Claim 11] The adsorbent sheet according to claim 10 with which it comes to carry out the laminating of said permeability sheet to the background layer of said granular-active-carbon content sheet.

[Claim 12] The adsorbent sheet according to claim 10 or 11 with which said permeability sheet becomes considering the nonwoven fabric which consists of film split mold electret fiber as a main constituent.

[Claim 13] The adsorbent sheet according to claim 12 with which it comes to give said permeability sheet the cover factor of the shape of the shape of a nonwoven fabric, the shape of textiles, and a network further.

[Claim 14] claims 10-13 whose pack density of said permeability sheet is 0.01-0.20g/cc -- an adsorbent sheet given in either.

, [Claim 15] claims 1-14 -- the filter for air cleaning which comes to cast an adsorbent sheet given in either the letter of a pleat, or in the shape of a wave.

[Claim 16] The filter for air cleaning according to claim 15 10-400mm and whose crest top-most-vertices spacing the thickness of a filter is 2-30mm.

[Claim 17] It is the manufacture approach of the adsorbent sheet which is a thing including the process which performs dehydration are the manufacture approach of an adsorbent sheet of having the formation process of a granular-active-carbon content sheet, and mechanical from the process which prepares the drainage system slurry in which the formation process of said granular-active-carbon content sheet contains granular active carbon with a mean particle diameter of 60-600 micrometers, support fiber, and the adhesive fiber of water bloating tendency, the process which develops said drainage system slurry in the shape of a field, and the drainage system slurry which developed, and desiccation.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the manufacture approach of the adsorbent sheet at the adsorbent sheet which has a deodorization



function and the filter for air cleaning with a dust-removing function and a deodorization function, and a list.

[0002]

[Description of the Prior Art] In order to show powerful adsorption capacity from the former to the solute in aerosol or a solution the top where permeability is cheaply [ granular active carbon ] good, generally it is used to purification, deodorization, etc. of a gas or a liquid.

[0003] There is sheet-like adsorption material which the aeration of the air to purify is made to carry out in the rectangular direction, and uses it for it to a sheet surface as one of the techniques which apply such granular active carbon to the filter for air cleaning. However, the granular active carbon in this sheet-like adsorption material will have the problem that will exfoliate simply and it will be spilt out from support, even if fabricating only by itself as filtration film is able to form a filtration membrane using a certain support rather than it is easy. From such a situation, development of the technique in which the above-mentioned granular active carbon can be effectively used as a material of the filter for air cleaning is desired.

[0004] On the other hand, what has been arranged with the rise of the problem of dust contamination combining the filter which has a dust-removing function as a filter for air clarification, and the filter which has a deodorization function has been demanded. However, in the configuration which is made to separate a dust filter and an odor removal filter, and is made to exist separately, there were the problem and the problem of being easy to become expensive in cost of a tooth space.

[0005] As a technique of using granular active carbon effectively as a material of the filter for air cleaning, the approach of supporting activated carbon to current, a nonwoven fabric, a network-like base material, or polyurethane foam is learned.

[0006] For example, adhesives are made for a Provisional-Publication-No. No. 72088 [ 48 to ] official report to adhere to a nonwoven fabric, and the adsorbent sheet which sprinkled activated carbon after that and was obtained is indicated. however, \*\* -- if an adsorbent sheet [ like ] tends to insist upon activated carbon firmly -- adhesives -- abundant -- the nonwoven fabric whole

surface -- a wrap -- things -- needed -- consequently, ventilation resistance -- high -- becoming -- moreover, sand dust, comparatively coarse dust, for example, pollen, spike dust, etc. -- receiving -- early blinding -- a lifting -- being easy -- \*\* -- there was a problem to say.

[0007] Moreover, the adsorbent sheet which the binder was applied [ sheet ] to polyurethane foam and made activated carbon support after that is indicated by the adsorbent sheet and the Japanese Patent Publication No. No. 35201 [ four to ] official report which the binder was applied [ official report ] to the network-like base material in order to reduce a pressure loss, and made activated carbon support after that in a publication-number No. 285531 [ nine to ] official report. However, such an adsorbent sheet needs to lay a certain sheet for activated carbon omission prevention on top of the downstream at least further, in order to use it as an actual filter application. Moreover, only by piling up simply, since the sheet for activated carbon omission prevention peels and falls while in use with a wind pressure, it is necessary to fix by a certain approach. Although there is the approach of using adhesives as that one approach, by this approach, the phenomenon same after all as \*\*\*\* arises, and ventilation resistance becomes high. Moreover, although there was a confounding method by needle punch as an approach which does not use a binder, since the support force of activated carbon was weak, omission of activated carbon became large, for this reason, the fall of deodorant ability was caused, and it was a problem practically.

[0008] Moreover, the fiber structure object which fixed granular active carbon etc. by thermal melting arrival in the nonwoven fabric matrix formed with the bicomponent fiber of thermal melting arrival nature fiber and other fiber is indicated by the U.S. Pat. No. 5605746 specification. Moreover, the manufacture approach which carries out dry type formation of the opened fiber web structure containing thermal melting arrival nature fiber and other fiber, heats on them after making a U.S. Pat. No. 5674339 specification distribute and incorporate granular active carbon, such as size suitable in the structure and weight, and fixes granular active carbon etc. to it by thermal melting arrival as the manufacture approach of such a fiber structure object is indicated.

[0009] However, since it was generally difficult to certainly fix by the approach of fixing granular active carbon by thermal melting arrival nature fiber as mentioned above so that there may be that no granular active carbon drops [ de], coexistence with firm maintenance of granular active carbon, and the adsorption engine performance and permeability was difficult like the above-mentioned conventional technique.

[0010] Granular active carbon is held firmly, and it excels in the adsorption engine performance and bending workability over stinkdamp, and a pressure loss is low, and the present condition is that the satisfying thing is not obtained with the adsorbent sheet or the filter for air cleaning which blinding to dust cannot produce easily as explained above.

[0011] On the other hand, in order to solve the problem in short of the dust-removing engine performance, the filter which carried out the laminating unification of a dust filter and the odor removal filter is proposed variously.

[0012] For example, the dust filter which used the electret-ized nonwoven fabric, and the odor removal filter which distributed granular active carbon in the latex are pasted up on a publication-number No. 74505 [ four to ] official report with hot melt adhesive, and the filter really cast in the pleat configuration is indicated. However, the electret-ized nonwoven fabric currently indicated by this official report is the so-called span bond type of electret nonwoven fabric, and this nonwoven fabric is [ a dust-removing function ] insufficient. Moreover, since blinding occurred at an early stage and a rapid pressure drop buildup was produced, it was what causes a filter life before the life of a deodorization sheet comes, and has a filter function and an economy top problem.

[0013] Moreover, a publication-number No. 265640 [ seven to ] official report is made to nap electret fiber, dust is caught in three dimension, and the filter which made blinding hard to produce is indicated. However, the dust-removing effectiveness with which the electret fiber currently indicated by this official report is also the so-called span bond type of electret filter, and the rate of electrification can be low satisfied of fiber enough was not acquired.

[0014] As above-mentioned, sufficient dust-removing effectiveness is demonstrated and the present condition is that the long compound functional

(dust-removing and deodorization) filter of a filter life does not exist.

[0015]

[Problem(s) to be Solved by the Invention] This invention is made in view of this situation, the purpose has good permeability and it is to provide with the manufacture approach of the adsorbent sheet the filter for air cleaning with which the adsorbent sheet excellent in the holdout of activated carbon and the outstanding dust-removing engine performance are maintained over a long period of time, and a list.

[0016] this invention persons found out that an adsorbent sheet with both the good fixed reinforcement and permeability of granular active carbon was obtained by not fixing activated carbon with adhesives and fixing granular active carbon by support fiber substantially, as a result of examining many things about the maintenance structure of the granular active carbon by fiber, and its formation, in order to solve the above-mentioned technical problem.

[0017] Moreover, the above-mentioned sheet found out that it could manufacture suitably by mixing and carrying out wet paper making of granular active carbon and the support fiber. In addition to above-mentioned granular active carbon and support fiber, it found out that it became possible stable to make firmer maintenance structure of the granular active carbon by support fiber by carrying out little addition of the adhesive fiber at that time.

[0018] Moreover, the adsorbent sheet which carries out the laminating unification of said deodorization sheet and electret nonwoven fabric, and is characterized by electret fiber being film split mold electret fiber further is offered. Moreover, the filter for air cleaning characterized by coming to cast this invention the letter of a pleat or in the shape of a wave in the above-mentioned adsorbent sheet is offered.

[0019] this invention persons reach this invention, as a result of inquiring further in piles based on the above-mentioned knowledge.

[0020]

[Means for Solving the Problem] That is, this invention like a degree can attain the above-mentioned purpose.

[0021] The adsorbent sheet of this invention is an adsorbent sheet which has a granular-active-carbon content sheet, and said granular-active-carbon

content sheet contains granular active carbon with a mean particle diameter of 60-600 micrometers, the support fiber contacted and fixed to the granular active carbon, and the adhesive fiber which mainly contributes to configuration maintenance. An adsorbent sheet with both the good fixed reinforcement and permeability of granular active carbon comes to be obtained by not fixing activated carbon with adhesives and fixing the activated carbon of specific particle diameter by support fiber substantially. That is, it makes it possible to maintain the ventilation resistance of the whole sheet low at the same time it makes the amount of the adhesive components used, such as adhesives, into the minimum and makes it possible to make the most of the deodorant ability of granular-active-carbon original.

[0022] As for said granular-active-carbon content sheet, in the above, it is desirable that the content of said granular active carbon consists of few surface layers and a background layer formed in the background of the surface layer as compared with other parts. \*\* -- by having a surface layer [ like ], the spill of granular active carbon can be more certainly prevented by bending in the condition of being hard to touch granular active carbon, and processing etc. becoming possible, and arranging a surface layer to the downstream, in case it is aeration. It is the case where it has more preferably the surface layer which does not contain granular active carbon from this viewpoint.

[0023] moreover, said granular-active-carbon content sheet is formed in one of wet adhesion, using water bloating tendency fiber as said adhesive fiber -- it is desirable. In such wet adhesion, since the adhesion force of support fiber and granular active carbon becomes large at the time of desiccation, \*\*\*\*\* is fixed to the interior of a sheet one-wise and firmly, and it becomes possible to make it very hard to produce of omission of the granular active carbon in the time of bending processing etc.

[0024] It is desirable that the outside-surface products of said support fiber are below 1m<sup>2</sup> / g, and fiber length is 3-20mm, and a consistency is 0.8-1.7g/cc. Thereby, the permeability of the adsorbent sheet obtained, the adsorption engine performance, paper-making nature, etc. become good.

[0025] It is desirable that said granular-active-carbon content sheet contains

said 30 - 80% of the weight of granular active carbon to the total weight.

Thereby, the adsorption engine performance of the adsorbent sheet obtained, reinforcement, etc. become good.

[0026] Moreover, it is desirable that said granular-active-carbon content sheet makes it come in the thickness direction to form the detailed hole which can carry out aeration substantially. While reducing a pressure loss further by making this air hole form, the amount of dust maintenance can be raised greatly and the life of an adsorption sheet can be improved further sharply.

[0027] that time -- said detailed average puncturing area per hole of a hole --  $0.5\text{mm}^2$  -  $3\text{mm}^2$  it is -- things are desirable. Moreover, the number of said detailed hole is said granular-active-carbon content sheet  $1\text{cm}^2$ . It is desirable that they are one - 20 hits. Furthermore, it is desirable that the numerical aperture of said detailed hole is 3% - 10%.

[0028] It is desirable that a permeability sheet is included in this invention in addition to the above granular-active-carbon content sheets. It is because omission prevention of the granular active carbon at the time of bending processing and the use as a filter etc. can be made into a more positive thing. Moreover, the pressure drop buildup by early blinding can be made hard to produce, since dust can be held comparatively uniformly in the sheet thickness direction when the load of the dust is carried out from the upstream, since the dense condition can be realized from \*\* when the pack density of the sheet thickness direction is considered. Therefore, it is desirable that the laminating of said permeability sheet is carried out to the background layer of said granular-active-carbon content sheet.

[0029] It is desirable in that case that said permeability sheet becomes considering the nonwoven fabric which consists of film split mold electret fiber as a main constituent. Thereby, the removal effectiveness over a submicron particle can be increased.

[0030] It is desirable to come to give said permeability sheet the cover factor of the shape of the shape of a nonwoven fabric, the shape of textiles, and a network further. Thereby, stabilization of dust-removing effectiveness, stabilization of the amount of dust maintenance, film split mold electret fiber fuzz prevention, etc. can make handling nature as a filter still better.

[0031] In addition, it is desirable that the pack density of said permeability sheet is 0.01-0.20g/cc. Thereby, the permeability of an adsorbent sheet, the amount of dust maintenance, reinforcement, and handling nature become still better.

[0032] On the other hand, the filter for air cleaning of this invention is a filter for air cleaning which comes to cast the above adsorbent sheets the letter of a pleat, or in the shape of a wave. Since the adsorbent sheet of this invention is used for this filter, its permeability is good and the dust-removing engine performance which excelled and was excellent in the holdout of activated carbon can maintain it over a long period of time. Furthermore, without producing omission of granular active carbon etc. as mentioned above at the time of processing, it can cast the letter of a pleat, or in the shape of a wave, and an effective filtration area can be enlarged.

[0033] It is desirable in that case that the thickness of a filter is [ 10-400mm and crest top-most-vertices spacing ] 2-30mm.

[0034] On the other hand, the manufacture approach of this invention is the manufacture approach of an adsorbent sheet of having the formation process of a granular-active-carbon content sheet, and the formation process of said granular-active-carbon content sheet includes the process which performs mechanical dehydration and desiccation from the process which prepares the drainage system slurry containing granular active carbon with a mean particle diameter of 60-600 micrometers, support fiber, and the adhesive fiber of water bloating tendency, the process which develops said drainage system slurry in the shape of a field, and the developed drainage system slurry.

[0035] since according to this manufacture approach a required adhesive component is very little and ends -- low -- a ventilation resistance granular-active-carbon content sheet can be formed, and the property of granular active carbon can be efficiently employed in the maximum. Moreover, the content of granular active carbon is able to form few surface layers as compared with a background layer using the speed difference of sedimentation of solid content.

[0036]

[Embodiment of the Invention] First, the outline structure of the adsorbent

sheet of this invention is explained, referring to a drawing.

[0037] Drawing 1 (A) shows the mimetic diagram of the adsorbent sheet of this invention formed only with the granular-active-carbon content sheet. The granular-active-carbon content sheet in this invention contains granular active carbon 1, the support fiber contacted and fixed to granular active carbon 1, and the adhesive fiber which mainly contributes to configuration maintenance. Here, support fiber and adhesive fiber are illustrated as an intermingled fiber component 2. With this gestalt, the content consistency of granular active carbon is high, and the surface layer L1 with few contents of granular active carbon 1 which is not contained preferably is formed in the upper front face for the drawing bottom as compared with the background layer L2. Such structure can be formed in the paper-milling process for performing wet adhesion using the speed difference of sedimentation of solid content. In addition, this drawing shows the structure of the adsorbent sheet of this invention typically, and this invention is not limited to the thing of such simple structure.

[0038] Drawing 1 (B) shows the mimetic diagram of the adsorbent sheet of this invention which has the permeability sheet L3 and a cover factor 4 further. With this gestalt, the laminating of the permeability sheet L3 and the cover factor 4 is carried out to the background layer L2 one by one. Moreover, the nonwoven fabric 3 which consists of film split mold electret fiber is especially used as a desirable permeability sheet L3. In addition, the arrow head shows the direction of the air flow in anticipated use.

[0039] Hereafter, the detail of each component is explained.

[0040] It is desirable that it is an average of 60-600 micrometers in the value according to a JIS standard sieve (JISZ8801) in consideration of omission of permeability and adsorption material, paper-making nature, etc., and if the mean particle diameter of the granular active carbon used for the adsorbent sheet of this invention is 100-500 micrometers, it is more desirable. When mean particle diameter is less than 60 micrometers, a pressure loss becomes large too much obtaining fixed high adsorption capacity, and sheet pack density tends to become high at coincidence, and it also becomes the cause which causes an early pressure drop buildup at the time of dust supply. When



mean particle diameter exceeds 600 micrometers, it becomes easy to produce omission, and the initial adsorption engine performance in one pass becomes extremely low, and bending when considering as filters for air cleaning, such as the shape of a pleat configuration and a honeycomb, further and the workability at the time of wavelike processing worsen.

[0041] In addition, the above-mentioned granular active carbon can be obtained by carrying out predetermined grain refining using the usual classifier.

[0042] Especially the class of granular active carbon used for the adsorbent sheet of this invention is not limited, and a coconut shell system, a woody system, a coal system, a pitch system, etc. are used suitably. Moreover, as for the above-mentioned granular active carbon, sized activated carbon, formed activated carbon, bead charcoal, etc. are used suitably geometrically.

[0043] The toluene amount of adsorption when measuring based on JISK1474 of the granular active carbon used for the adsorbent sheet of this invention has 20 desirable % of the weight or more. It is because the high adsorption engine performance is needed to non-polar gases, such as stinkdamp, and the liquefied matter.

[0044] For the purpose of improving the adsorption engine performance of a polar substance, the granular active carbon used for the adsorbent sheet of this invention may perform a chemical treatment, and may be used. as the chemical used for a gas chemical treatment -- aldehyde system gas and N Ox As opposed to acid polar substances, such as sulfur compounds, such as a nitride and SOx, and an acetic acid, etc. -- For example, ethanolamine, polyethyleneimine, an aniline, P-anisidine, Amine system drugs, such as a sulfanilic acid, a sodium hydroxide, a potassium hydroxide, Guanidine carbonate, guanidine phosphate, aminoguanidine sulfate, 5, and 5-dimethylhydantoin, Benzoguanamine, 2, and 2-imino JIETA Norian, 2 and 2, 2-nitro triethanol, An ethanolamine hydrochloride, 2-aminoethanol, 2, and 2-imino JIETA Norian hydrochloride, p-aminobenzoic acid, sulfanilic-acid sodium, L-arginine, A monomethylamine hydrochloride, a semicarbazide hydrochloride, a hydrazine, a hydroquinone, Hydroxylamine sulfate, a permanganate, potassium carbonate, a potassium hydrogencarbonate, etc.

are used suitably. To basic polar substances, such as ammonia, monomethylamine, a trimethylamine, and a pyridine, a phosphoric acid, a citric acid, a malic acid, an ascorbic acid, etc. are used suitably, for example. In addition, a chemical treatment is performed by making granular active carbon support a chemical, or installing. Moreover, it is also possible on the approach of carrying out installation processing with the usual coating method etc. near a sheet surface front face besides processing a direct chemical to activated carbon, or the whole sheet to carry out sinking-in installation.

[0045] As for the granular-active-carbon content sheet contained in the adsorbent sheet of this invention, it is desirable to contain granular active carbon 30 to 80% of the weight. In not obtaining the good adsorption engine performance but exceeding 80 % of the weight, the reinforcement of an adsorbent sheet falls to less than 30% of the weight of a case.

[0046] As for the granular-active-carbon content sheet contained in the adsorbent sheet of this invention, it is desirable to contain support fiber five to 50% of the weight. At less than 5 % of the weight, when paper-making nature worsens and exceeds 50 % of the weight, an adsorption effect serves as a defect.

[0047] As for the outside-surface product of the support fiber used for the adsorbent sheet of this invention, it is desirable that they are below  $1\text{m}^2 / \text{g}$ . When exceeding  $1\text{m}^2 / \text{g}$ , it is for permeability and paper-making nature to fall.

[0048] In addition, both fibrillated fiber and fiber which has not been fibrillated are used as the above-mentioned support fiber.

[0049] As for the fiber length of the support fiber used for the adsorbent sheet of this invention, it is desirable that it is 3-20mm. When in the case of less than 3mm permeability worsens and exceeds 20mm, the formation of paper-making nature or a sheet worsens and the variation in ventilation resistance and the adsorption engine performance becomes large.

[0050] As for the specific gravity of the support fiber used for the adsorbent sheet of this invention, it is desirable that it is 0.8-1.7g/cc. Since support fiber and granular active carbon are separated and formed in a paper-making slurry generate time when specific gravity is less than 0.8g/cc, the precise layer of support fiber is formed in a surface layer, and a pressure loss

becomes high, and it becomes inadequate insisting [ of the granular active carbon by support fiber ], and omission of granular active carbon become large. Since the specific gravity difference with granular active carbon (specific gravity 1.8 [ about ]) is small when specific gravity surpasses cc in 1.7g /, a surface layer is not formed and the original purpose cannot be attained.

[0051] Moreover, as the above-mentioned support fiber, a being [ a hydrophilic property ] thing is desirable. It is for forming an activated carbon content sheet more firmly.

[0052] Especially the quality of the material of the support fiber used for the adsorbent sheet of this invention is not limited, and a linter besides synthetic fibers, such as polyester, a polyacrylonitrile, a polyamide, and polyolefine, cotton, hemp, wood pulp, rayon, a glass fiber, etc. are used. Preferably, they are wood pulp, rayon, polyester, polyolefine, and a polyamide.

[0053] In addition, a concentric circle form or a variant cross section is sufficient as a fiber configuration. Moreover, the fiber which \*\*\*\* required can also be used.

[0054] Vinyon, a polyethylene fiber, polypropylene-polyethylene and a polyester bicomponent fiber, a polyamide bicomponent fiber, etc. are used suitably that the adhesive fiber used for the adsorbent sheet of this invention should just be a thing used as the adhesion component at the time of mixing, such as water bloating tendency fiber and thermofusion nature fiber, (binder).

[0055] Moreover, the fiber which has side-by-side structure or \*\*\*\* also by the sheath core fabric is sufficient as these fiber.

[0056] As for the specific gravity of the adhesive fiber used for the adsorbent sheet of this invention, it is desirable that it is 0.8-1.7g/cc, and it is desirable to have the almost same specific gravity (\*\*10%) as the aforementioned support fiber especially. It is for existing near the support fiber and making good gestalt holdout of the surface layer of a granular-active-carbon content sheet, and a background layer after paper-making slurry generation.

[0057] As for the fiber length of the adhesive fiber used for the adsorbent sheet of this invention, it is desirable that it is 1-20mm. When in the case of less than 1mm permeability worsens and exceeds 20mm, the formation of

paper-making nature or a sheet worsens and the variation in ventilation resistance and the adsorption engine performance becomes large.

[0058] Its 1 - 30 % of the weight is desirable, and if the mixing rate of the adhesive fiber used for the adsorbent sheet of this invention is 5 - 20 % of the weight, it is more desirable. In being unable to demonstrate the function as an adhesion component but exceeding 30 % of the weight, adsorbent falls to less than 1% of the weight of a case relatively, and a pressure loss also goes up to it.

[0059] The adsorbent sheet of this invention may be constituted including the component which has subordinate functions, such as an antimicrobial agent, an antifungal agent, an antiviral agent, and a flame retarder. Although these components are scoured in fiber, by post processing, it may install and support and they may be given. For example, it is possible by constituting including a flame retarder to manufacture the adsorbent sheet corresponding to criteria and UL fire retardancy specification of \*\*\*\*\* specified by FMVSS.302.

[0060] The component which has the above-mentioned subordinate function may be installed or supported to granular active carbon. However, in this case, it is necessary to take care so that the adsorption function of granular-active-carbon original may not be spoiled.

[0061] Moreover, it is also possible to strengthen a deodorization function by using for fiber the fiber which has the adsorption engine performance, for example, ion-exchange fiber etc.

[0062] The thickness of the adsorbent sheet of this invention has 0.3-2.5 desirable mm. It is for making permeability and workability good.

[0063] The weight of the adsorbent sheet of this invention is 50 g/m<sup>2</sup>. The above is desirable and it is 200 g/m<sup>2</sup>. Since it will become what further high adsorption capacity-ization can be realized and the removal effectiveness is sensed more sensuous as if it is above, it is suitable.

[0064] The pack density of the adsorbent sheet of this invention is desirable if it is 0.15-0.3g/cc, and if it is 0.17-0.25g/cc, it is more desirable. When dust removal effectiveness becomes low and exceeds cc in 0.3g /in the case of less than 0.15g/cc, blinding causes an early pressure drop buildup and it is

not desirable as a filter. In order to adjust to such a sheet consistency, since it becomes easy between fiber and activated carbon to give an opening, it is desirable by carrying out optimum dose mixing of the thing of 15 micrometers or more of diameters of fiber into support fiber.

[0065] Although the granular-active-carbon content sheet contained in the adsorbent sheet of this invention can be manufactured by various approaches, the manufacture approach of this invention can apply it as a suitable thing especially. The manufacture approach of this invention is the manufacture approach of an adsorbent sheet of having the formation process of a granular-active-carbon content sheet, and the formation process of said granular-active-carbon content sheet includes the process which performs mechanical dehydration and desiccation from the process which prepares the drainage system slurry containing granular active carbon with a mean particle diameter of 60-600 micrometers, support fiber, and the adhesive fiber of water bloating tendency, the process which develops said drainage system slurry in the shape of a field, and the developed drainage system slurry. A desirable gestalt is explained based on drawing 2 .

[0066] The above-mentioned drainage system slurry is usually prepared with a conventional method by using water or a water solution as a dispersion-medium object, and is supplied from the pars basilaris ossis occipitalis of a container 12. While it is developed by the top face of the reticulated endless belt 11 in the shape of a field and the supplied drainage system slurry is conveyed on it, mechanical dehydration is performed gradually and humid Webb 18 is formed. In that case, as mechanical dehydration, approaches, such as a long network type, a short network type, and a cylinder-mould type, can be adopted, and suction dehydration etc. is possible in extracting lightly by press rollers 13 and 14 further.

[0067] Then, even the rotation desiccation drum 6 is conveyed by the endless belt 15 for sheet conveyance, and on the rotation desiccation drum 16, contact desiccation can be carried out and it can consider as the adsorbent sheet 19. The adsorbent sheet of this invention can be manufactured as a continuation object by performing a series of processes continuously, rolling round this adsorbent sheet 19 and rolling round with a roll 17. In the above-

mentioned case, optimum dose addition of the dispersant and flocculant of a macromolecule system and an inorganic system can be carried out into a slurry, and the yield can also be raised.

[0068] The above-mentioned slurry is slushed into the metal mold and the plastic pattern in which the hole with permeability opened on the other hand, and the adsorbent sheet of this invention can be manufactured also by the approach of attracting and drying after that. Moreover, nonwoven fabric Webb containing support fiber and adhesive fiber is produced beforehand, and it can manufacture also by the approach of sheet-izing by the approach of distributing activated carbon and spraying hot blast after that into this. However, when the homogeneity dispersibility of activated carbon etc. is taken into consideration, it is more desirable to manufacture through the process distributed to underwater [ above-mentioned ]. The adsorbent sheet of this invention can raise a property further as mentioned above by making an air hole form in the thickness direction of this adsorbent sheet substantially.

[0069] In addition, even if this air hole has penetrated the adsorbent sheet, it is a hole which did not need to penetrate and was prepared in the thickness direction of an adsorbent sheet, and should just be a hole which can carry out aeration substantially.

[0070] the average puncturing area per hole of the air hole formed in the adsorbent sheet of this invention --  $0.5\text{mm}^2$  -  $3\text{mm}^2$  it is -- things -- desirable --  $1\text{mm}^2$  -  $2\text{mm}^2$  it is -- if -- it is more desirable. Average puncturing area is 2  $0.5\text{mm}$ . When it is the following, the effectiveness of blinding reduction over a ventilation resistance fall or dust is small. Average puncturing area is 2  $3\text{mm}$ . In exceeding, insisting [ of granular active carbon ] becomes inadequate and there is a possibility that omission of granular active carbon may occur.

[0071] in addition, the microscope under which the area measurement function was attached about what sampled measurement of the average puncturing area per hole in the magnitude of  $1\text{cm}$  angle from three points of the arbitration of an adsorbent sheet, for example, KEYENCE CORP. make, -- highly minute -- it measures using digital microscope VH-6300.

[0072] It is desirable that it is 3% - 10%, and if the numerical aperture of the air hole formed in the adsorbent sheet of this invention is 5% - 8%, it is more

desirable. When a numerical aperture is less than 3%, the effectiveness of blinding reduction over a pressure-loss fall or dust is small. When a numerical aperture exceeds 10%, insisting [ of granular active carbon ] becomes inadequate and there is a possibility that omission of granular active carbon may occur.

[0073] In addition, about what was sampled in the magnitude of 1cm angle from three points of the arbitration of an adsorbent sheet, measurement of a numerical aperture asks for total of puncturing area, and asks for it by the following formula.

[0074]

$$\text{total / sample area} \times 100 \text{ of numerical aperture (\%)} = \text{puncturing area}$$
 -- the number of the detailed hole which will be formed in an adsorbent sheet if the above average puncturing area and numerical apertures are taken into consideration -- granular-active-carbon content sheet 1cm<sup>2</sup> per -- it is especially desirable that they are 5-15 pieces one - 20 pieces.

[0075] Especially the puncturing approach of the air hole formed in the adsorbent sheet of this invention is not limited, and independence or the approach of combining and using is suitably used in the needle punch method, the air punching method, a stream confounding method, etc. Moreover, especially the configuration of an aperture is not limited, either and the shape of cylindrical and a cone etc. is used suitably.

[0076] Although the adsorbent sheet of this invention has very few omission of activated carbon and has low ventilation resistance, high deodorant ability, and the high dust-removing engine performance also as [ this ], it is more desirable than the above-mentioned reason to carry out the laminating of the permeability sheet to the background layer of the granular-active-carbon content sheet explained above.

[0077] Especially the class of permeability sheet used for the adsorbent sheet of this invention is not limited, and the shape of the shape of the shape of a nonwoven fabric and textiles and knitting etc. is used suitably.

[0078] Especially the quality of the material of the permeability sheet used for the adsorbent sheet of this invention is not limited, and independently [ KURARU / wood pulp, rayon, acetate, polyester, a polyacrylonitrile, a

polyamide, polypropylene, polyethylene / poly ], it can mix and it can be used.

[0079] If the laminating of the electret-ized so-called sheet by which permanent electrification was carried out especially is carried out as a permeability sheet used for the adsorbent sheet of this invention, the removal effectiveness over submicron particles including a tobacco smoke particle, a carbon particle, and a sea salt particle can also increase. As an approach of obtaining this electret-ized sheet Although the fiber which consists of a raw material in which electret-izing is possible is fabricated to a nonwoven fabric, corona electric charge processing can be performed or well-known approaches, such as the film split method which carries out fiber split fibrosis of the electret-ized film, and is fabricated to a nonwoven fabric, can be used especially -- electric charge effectiveness -- high -- \*\* -- it is desirable to use the film split method [ sheet-izing in the high condition is possible, and ] which can stop a pressure loss low.

[0080] Especially the material of film split mold electret fiber used for this invention is not limited, and fluorine system polymers, such as alpha-polyolefine system polymers, such as polyolefine system polymers, such as polypropylene, polyethylene, and syndiotactic polystyrene, and Polly 4-methyl-1-pentene, and Teflon, a polycarbonate, polyester, etc. are used suitably.

[0081] After it forms an oriented film by not being limited, and producing a cast film by melting extrusion from the above-mentioned resin, for example, subsequently to length or a longitudinal direction extending this film 5 to 10 times, especially the manufacture approach of the film split mold electret fiber used for this invention is used as an electret film by the electric charge, and by the filamentation cutter, the split of it is carried out and it is manufactured.

[0082] in addition, the electric charge of an oriented film is independent in electric charge methods, such as corona discharge, electric-field discharge, electron beam irradiation, and frictional electrification, -- or it can combine and use. Moreover, as an approach of carrying out the split of the electret film, the approach by the needle type cutter, the \*\*\*\* type cutter, a blade type cutter, etc. is used.

[0083] the average split width of face of the electret fiber of the film split mold



used for this invention -- desirable -- 10 micrometers - 500 micrometers more -- desirable -- 20 micrometers - 300 micrometers most -- desirable -- 40 micrometers - 200 micrometers it is .

[0084] the thickness of the electret film of the electret fiber of the film split mold used for this invention -- 3 micrometers - 30 micrometers It is desirable.

[0085] Although it is desirable to have the maximum surface density of charge shown by Ruth's formula as for the surface charge consistency of the electret fiber of the film split mold used for this invention, it is not limited to it.

[0086] The pack density called for by the following formula of the film split mold electret fiber in the dust-removing sheet used for this invention has desirable cc in 0.01-0.20cc /. In exceeding cc in 0.20cc /, it becomes still higher-density for press at a unification process with a deodorization sheet, and ventilation resistance becomes high. The handling in respect of reinforcement will become [ maintaining the stable consistency ] difficult for the case of less than 0.01cc/cc difficult.

[0087] In addition, the above-mentioned pack density says the pack density of the film split mold electret fiber in a dust-removing sheet, and is calculated by the following formula.

[0088]

Pack density (cc/cc) = (Wx10<sup>-4</sup>) / (Txrho)

However, W: The eyes of a fiber layer (g/m<sup>2</sup>)

T: Thickness of a fiber layer (cm)

rho: The consistency of fiber (g/cc )

The eyes of the film split mold electret fiber in the dust-removing sheet used for this invention are 5-250g/m<sup>2</sup>. It is desirable. Eyes are 5 g/m<sup>2</sup>. When it is the following, the collection efficiency of dust is low, and it is 250 g/m<sup>2</sup>. In exceeding, it becomes easy to produce blinding.

[0089] An additive may be used in order for the film split mold electret fiber used for this invention to improve electrification nature. Especially the additive used here is not what is limited. For example, phosphoric-acid bis(4-t-buthylphenyl) sodium, Sodium 2, a resin amelioration agent like 2'-ethylidene bis(4, 6-G t-buthylphenyl) phosphate, Tris (3, 5-G t-butyl-4-hydroxybenzyl) isocyanurate, 1, 1, 3-tris (2-methyl-4-hydroxy-5-t-buthylphenyl) butane, 1, 1,

bis(2'-methyl-4-hydroxy-5'-tert-butylphenyl) butane, A 2 and 2-thio-diethylene screw [3-(3, 5-G tert-butyl-4-hydroxyphenyl) polo PIONETO], 3, 9-screw [2-(3-tert-butyl-4-hydroxy-5-methylphenyl) propionyloxy]-1 and 1-dimethyl ethyl]-tetraoxaspiro [2, 8, and 10-] [5, 5] undecane, Bis(2,4-di-tert-butylphenyl)pentaerythritoldiphosphite, A bis(2, 6-G tert-butyl-4-methylphenyl) pen TAERISUTORITO-RUJIHOSU fight, Ethylidene bis(4,6-di-tert-butylphenyl)octyl phosphite, An anti-oxidant like tris-(2, 4-G tert-butylphenyl) phosphite, 3-(N-SARICHI roil) amino - 1, 2, 4-triazole, a heavy-metal deactivator like Deccan dicarboxylic acid JISARICHI roil hydrazide, 2-(2'-hydroxy-5'-methylphenyl) benzotriazol, 2-(2'-hydroxy-3'-tert-butyl -5'-methylphenyl)-5-chlorobenzo triazole, 2 and 2'-methylenebis [a 4-(1,1,3,3-tetramethylbutyl)-6-(2N-benzotriazol-2-IRU) phenol], Screw (5-benzoyl-4-hydroxy-4-piperidyl) - 1, 2, 3, a 4-butane tetra-KARUBIKISHI rate, 1, 2, 2, 6, and 6-pentamethyl-4-piperidyl / beta and beta, beta', and beta -- ' -- light stabilizer like a - tetramethyl-3 and 9-[2, 4, 8, and 10-tetraoxaspiro (5 5) undecane] diethyl (mixing) -1, 2 and 3, and 4-butane tetra-KARUBIKISHI rate -- A fatty-acid metal salt like magnesium stearate, aluminum stearate, and lauric-acid aluminum etc. is used suitably.

[0090] Moreover, although the addition of these additives changes also with classes of additive, 0.05 - 5% of the weight of its range is effective to the weight of film split mold electret fiber.

[0091] As for the dust-removing sheet used for this invention, it is more desirable to give a cover factor as mentioned above. As a gestalt of said cover factor, the shape of the shape of a nonwoven fabric and textiles, a network-like base material, etc. are used suitably.

[0092] What is necessary is just to carry out the laminating unification of the nonwoven fabric which makes the main constituent a cover factor and the above-mentioned film split mold electret fiber as an approach of giving said cover factor with mechanical confounding methods, such as the needle punch method and the Ayr punching method.

[0093] Especially as a material of said cover factor, it is not limited and a polyamide, polypropylene, rayon, polyester, polytetrafluoroethylene, polyvinyl alcohol, a polyacrylonitrile, poly KURARU, polyethylene, etc. are mentioned.

[0094] In order to harness low voltage loss and a high dust elimination factor

as much as possible, low eyes are desirable as much as possible, and the eyes of said cover factor are 5 g/m<sup>2</sup> - 100 g/m<sup>2</sup>. It is desirable.

[0095] Moreover, if thermal melting arrival fiber is mixed into said cover factor and it welds to \*\*\*\*\* fiber, fuzz can be controlled more and it is still more desirable.

[0096] The configuration of versatility [ cross section / of the thermal melting arrival fiber in this case ], such as a round-head cross section and a short form cross section, is used. The resin of a single component is sufficient as thermal melting arrival fiber, and it may consist of two or more components. As thermal melting arrival fiber which consists of multicomponent, the cross-section configuration which has side-by-side structure and a sheath core fabric is mentioned. For example, about the fiber which has a sheath core fabric, the direction of the sheath section uses resin with melting temperature lower than the core section. The combination which uses the combination and sheath which use a sheath as polyethylene or an ethylene vinyl acetate copolymerization object, and use a core as polypropylene copolymerized polyester with low melting temperature as such combination, for example, and uses a core as polyethylene terephthalate is mentioned. thus, melting only of the surface part is carried out in temperature predetermined by making into fiber with low melting temperature the resin with which melting temperature differs on the front face of combination and fiber -- making -- the configuration of internal fiber -- it remains as it is -- it can hold. Moreover, though natural, two or more layer laminating of these fiber layer may be carried out.

[0097] Even if it mixes further antibacterial fiber, deodorization fiber, aroma fiber, fire-resistant fiber, the fiber by which the span bond type and the melt-blown type were formed into the electret filter, or a nonwoven fabric in the range which does not lose the function of a fiber layer, it does not interfere with the nonwoven fabric which makes the main constituent the film split mold electret fiber used for this invention.

[0098] Its cc is desirable in 0.01-0.20g /, and if the pack density of the dust-removing sheet used for this invention is 0.02-0.15g/cc, it is more desirable. In exceeding cc in 0.20g /, a pressure loss becomes high and the amount of dust maintenance becomes low. To the case of less than 0.01g/cc, reinforcement

is weak, and handling nature worsens at it.

[0099] In addition, the pack density of a dust-removing sheet means the pack density containing the film split mold electret fiber which constitutes a dust-removing sheet, or all the additives of a hippo factor and others, and it is calculated by the following type.

[0100] Pack density (g/cc) = thickness of the eyes (g/cm<sup>2</sup>) / dust-removing sheet of a dust-removing sheet (cm)

By the above, the thickness of a dust-removing sheet is load 180 gf/cm<sup>2</sup> to an adsorbent sheet. It asks as a difference of the thickness of the adsorbent sheet when applying a pressure, and the thickness of a deodorization sheet.

[0101] In the adsorbent sheet of this invention the laminating approach of a granular-active-carbon content sheet and a permeability sheet what is limited especially -- not but -- for example, the pasting-up method which it is also good to pile up simply and used spreading of a small amount of adhesives, or thermal melting arrival nature -- for example The approach which does not use binders, such as an approach of blowing adhesion fiber upon an adaptered, the approach of inserting an adhesive sheet between sheets and pasting up, and the approach of making carry out welding with a supersonic wave, and pasting up, needle punch, Ayr punch, a stream confounding method, may be used. Anyway, since it will arrange to the upstream, a permeability sheet does not peel simply with a wind pressure, and not much firm adhesion is unnecessary.

[0102] As for the filter for air cleaning of this invention, it is desirable to come to cast the adsorbent sheet explained above the letter of a pleat and in the shape of a wave.

[0103] The thickness of the cast filter for air cleaning has 10-400 desirablemm. It is desirable when about 40-400mm will think from storage space, if it is the large-sized filter unit which will often be installed from the relation of the usual internal tooth space to about 10-60mm and a building air-conditioning application if it is mounted applications and home air cleaners including interior wearing of a car air-conditioner.

[0104] Rib crest top-most-vertices spacing of the filter for air cleaning of this invention has 2-30 desirablemm. 2mm or less -- a rib -- a gap sticks too much

and comes out, and there is much dead space and it becomes impossible to utilize a sheet efficiently. Since sheet expansion area becomes small, it becomes impossible on the other hand, to acquire the removal effectiveness according to filter thickness in 30mm or more.

[0105] As for the filter for air cleaning of this invention, it is more desirable to come to arrange the surface layer of a granular-active-carbon content sheet from a background layer to the downstream what was made into a permeability sheet and one. \*\* -- the permeability sheet unified by making it like -- more -- peeling omission -- hard -- it is because it becomes.

[0106]

[Example] Although an example explains this invention to a detail further below, the following example is not the thing of the property which limits this invention, and each thing done for a design change in accordance with before and the after-mentioned meaning is included in the technical range of this invention.

[0107] In addition, the numeric value in an example is a value measured by the following approaches.

[0108] (1) Use the mixed fine particles of the amount following of 15 sorts of JIS dust maintenance, and they are linear velocity 30 cm/s and supply concentration 0.5 g/m<sup>3</sup>. It supplied under conditions, the time of going up by 150Pa from initial pressure loss was judged to be a life, and weighing capacity of this amount of dust deposited on the filtering medium at the time was carried out with the balance. This value shows the substitution property of whenever [ to dust / blinding ].

[0109]

Eight sorts (an average of about 8 micrometers, Kanto loam) of presentations JIS of mixed fine particles 72-% of the weight carbon black (an average of about 0.1 micrometers) 23-% of the weight cotton linter (an average of about 1.5 micrometers) The pressure loss when carrying out aeration under the conditions of 5-% of the weight ventilation-resistance [ (2) ] linear velocity 30 cm/s was measured.

[0110] (3) In linear velocity 30 cm/s, the particle concentration of the vertical style of a filter was measured at the particle counter (the Rion make, KC-01C)

using the NaCl particle with a particle removal effectiveness of 0.3 micrometers, respectively, and the percentage of the value which <sup>\*\*</sup>(ed) by the particle concentration of the upstream showed the value which subtracted the particle concentration of the downstream from the particle concentration of the upstream.

[0111] (4) Sheet pack density sheet pack density (g/cc) = sheet eyes / sheet thickness [sheet thickness is value] under the load of 180 gf/cm<sup>2</sup>.

(5) Under the conditions of peeling linear velocity 30 cm/s of a reinforcement sheet, the peeling nature from the body sheet of a reinforcement sheet was also compared.

[0112] (Example 1) The mean particle diameter of 310 micrometers, JIS K The toluene adsorption capacity measured by 1474 law distributed underwater the polyvinyl alcohol 12 weight section with a 1 denier x fiber length of 3mm which is 18 weight sections and hydrothermal melting nature fiber in the granular active carbon which is 470 mg/g about a rayon fiber with 70 weight sections and a 8 denier x fiber length of 8mm by the pulper, and prepared the undiluted solution for wet paper making. Using the equipment shown in drawing 2 , paper making of this was carried out by the long network type paper-making method, humid Webb was built, it dried on the rotation desiccation drum by 140 degrees C of diaphragms lightly after that with the press roller, and the low pack density adsorption sheet of eyes 300 g/m<sup>2</sup> and 0.21g/cc of sheet pack density was obtained. On the paper-making screen, according to the specific gravity difference of granular active carbon, rayon (specific gravity 1.5 [ about ]), and polyvinyl alcohol (specific gravity 1.3 [ about ]), the difference in settling velocity arose and this sheet has formed the surface layer which consists of an activated carbon content layer (background layer), support fiber, and adhesive fiber as a result.

[0113] When the background layer of this sheet is arranged for the upstream and the pressure loss was measured, it was very as low as 30Pa, and the toluene amount of adsorption became the sheet which exists no less than 33% of sheet weight, and has high adsorption capacity very much. Moreover, there are also no omission of granular active carbon while in use as a filter, and it excelled in handling nature very much. furthermore -- it should mention

especially -- a pressure drop buildup when [ of 15 sorts of JIS ] dust load is carried out, until it reaches final pressure -- very much -- loose -- blinding -- carrying out -- hard -- final -- 40 g/m<sup>2</sup> Thing dust has been held. That is, it is the sheet which was excellent not only in a deodorization function but the dust-removing function. Moreover, when this sheet was processed with the reciprocating type rib cage machine with a filter thickness [ of 40mm ], and a rib crest top-most-vertices spacing of 7mm in the shape of a pleat and it was made the filter unit, it turned out that there is also no generating of a crack on a rib crest fold, and it does not landslide even if this filter is strong and it gives the field wind speed of 4 m/s from a chip box crest side, but it excels in workability very much, and excels in handling nature.

[0114] (Example 2) The mean particle diameter of 310 micrometers, JIS K The granular active carbon whose toluene adsorption capacity measured by 1474 law is 470 mg/g 70 weight sections, A rayon fiber with a 8 denier x fiber length of 8mm Ten weight sections, the fibrous polyvinyl alcohol 12 weight section with a 1 denier x fiber length of 3mm, The polyester bicomponent fiber 8 weight section with a 2 denier x fiber length of 5mm which has a sheath core fabric and has the melting point whose sheath side is 110 degrees C was underwater distributed by the pulper, and the undiluted solution for wet paper making was prepared. Paper making of this was carried out by the long network type paper-making method, humid Webb was built, it dried on the rotation desiccation drum by 140 degrees C of diaphragms lightly after that with the press roller, and the low pack density adsorption sheet of 400g of eyes/, m<sup>2</sup>, and 0.18g/cc of sheet pack density was obtained. This sheet was the same as that of an example 1, and has formed the surface layer which consists of an activated carbon content layer (background layer), and support fiber and an adhesion fiber layer according to the difference in settling velocity.

[0115] When the background layer of this sheet is arranged to the upstream and ventilation resistance was measured, it was very as low as 32Pa, and the toluene amount of adsorption became the sheet which exists no less than 33% of sheet weight, and has high adsorption capacity very much. Moreover, there are also no omission of granular active carbon while in use as a filter, and it excelled in handling nature very much. furthermore -- it should mention

especially -- a pressure drop buildup when [ of 15 sorts of JIS ] dust load is carried out, until it reaches final pressure -- very much -- loose -- blinding -- carrying out -- hard -- final -- 38 g/m<sup>2</sup> Thing dust has been held. That is, it can be said to be the sheet which was excellent not only in a deodorization function but the dust-removing function. Moreover, in order to check real effectiveness from that of this adsorbent sheet, it was processed with filter transverse-plane size 200mmx180mm, a filter thickness [ of 40mm ], and a rib crest top-most-vertices spacing of 7mm in the shape of a pleat, and what attached and carried out unitization of the frame material for end-face immobilization further was installed in the interior of a car air-conditioner. Air-conditioner mode was made open air installation, and was operated by the steady state (AUTO) of field wind-speed 1 m/s extent. Although air conditioning capacity hardly changed as compared with the time of filter un-equipping, when flattery transit of the 10m of the back of a diesel exhaust gas vehicle was carried out, all in-the-car passengers (four panelists) did not sense an unpleasant-smell mind peculiar to diesel exhaust gas.

[0116] (Example 3) Granular active carbon is an average of 130 micrometers, 170g of eyes/, and m<sup>2</sup>. It is the same approach as an example 2, and the deodorization sheet was produced by the same support fiber and the adhesion fiber ratio. When the background layer of this sheet is arranged to the upstream and the pressure loss was measured, it was very as low as 28Pa, and the toluene amount of adsorption became the sheet which exists no less than 33% of sheet weight, and has high adsorption capacity very much. Moreover, there are also no omission of granular active carbon while in use as a filter, and it excelled in handling nature very much. furthermore -- it should mention especially -- a pressure drop buildup when [ of 15 sorts of JIS ] dust load is carried out, until it reaches final pressure -- very much -- loose -- blinding -- carrying out -- hard -- final -- 41 g/m<sup>2</sup> Thing dust has been held. That is, it can be said to be the sheet which was excellent not only in a deodorization function but the dust-removing function.

[0117] (Example 1 of a comparison) Eyes 20 g/m<sup>2</sup> whose ventilation resistance is 5Pa 10% of butadiene acrylonitrile water dispersion was injected to the low voltage disadvantage nonwoven fabric made from polypropylene,



and the 210g of the same activated carbon as an example 1 was supported after simple desiccation. The ventilation resistance of this sheet became 60Pa and a very high thing. Moreover, when the load of the dust of 15 sorts of JIS is carried out, a pressure drop buildup starts at an early stage, and finally they are 10 g/m<sup>2</sup>. Deer dust was not able to be held.

[0118] (Example 2 of a comparison) The activated carbon same after a pressure loss carries out the dipping of the acrylonitrile butadiene system latex emulsion to the mesh-like network which are eyes 50 g/m<sup>2</sup> made from polypropylene which is 2Pa, and 4x4mm of openings and extracts it to it lightly between rubber covered rolls as a binder as an example 1 was supported, it extracted between rubber covered rolls further, and excessive activated carbon was blown away by the air blow after that. The ventilation resistance of this sheet was what omission of activated carbon cannot use as a practical use filter the way things stand greatly with 30Pa although it was low. Eyes 20 g/m<sup>2</sup> used in the example 1 of a comparison in order to prevent omission of activated carbon It was not what the problem that omission of activated carbon are large although the nonwoven fabric made from polypropylene was united with the downstream in law at needle punch, and this nonwoven fabric peels and falls while in use arises, and can be very equal to use.

[0119] The above-mentioned result is shown in Table 1.

[0120]

[Table 1]

	材料		特性				
	活性炭平均 粒子径 ( $\mu\text{m}$ )	繊維成分	シート中の 活性炭量 ( $\text{g}/\text{m}^2$ )	圧損 (Pa)	JIS15種 保持量 ( $\text{g}/\text{m}^2$ )	活性炭 脱落性	補強シート のはがれ
実施例1	310	レーヨン8d×8 ポリアクリレート1d×3	210	30	40	良好	なし
実施例2	310	レーヨン8d×8 ポリアクリレート1d×3 ポリエステル複合繊維2d×5	280	32	38	良好	なし
実施例3	130		120	28	41	良好	なし
比較例1	310	ポリアクリレート製不織布	210	60	10	良好	なし
比較例2	310	ポリアクリレート製網状ネット	210	30	30	不良	あり

(Example of production of a dust-removing sheet) The dust-removing sheet

electret-ized [ following ] was produced.

[0121] Eyes 30 g/m<sup>2</sup> which consists only of electret film split fiber made from polypropylene (lauric-acid aluminum 0.3% content) with 8.5 micrometers [ in dust-removing sheet A thickness ], and an average split width of face of 65 micrometers The electret split fiber layer was produced. Although the pressure loss of this fiber layer was very as low as 7Pa, particle removal effectiveness was very as big as 40%.

[0122] Eyes 30 g/m<sup>2</sup> which consists of electret film split fiber made from polypropylene (lauric-acid aluminum 0.3% content) with 8.5 micrometers [ in dust-removing sheet B thickness ], and an average split width of face of 65 micrometers Electret split fiber layer, 10g of eyes of 4-denier thermal melting arrival fiber/and m<sup>2</sup> which a core becomes [ a sheath ] from polyethylene terephthalate by copolymerized polyester A laminating is carried out.

Subsequently, they are 50 punch / inch<sup>2</sup> about a punch consistency. Needle punch processing was performed, it heat-treated in hot blast oven for 30 seconds at 120 degrees C after that, and the film split mold electret fiber layer A was produced. Although the ventilation resistance of this fiber layer was very as low as 8Pa, particle removal effectiveness was very as big as 40%.

[0123] Eyes 30 g/m<sup>2</sup> which consists of electret film split fiber made from polypropylene (lauric-acid aluminum 0.3% content) with 8.5 micrometers [ in dust-removing sheet C thickness ], and an average split width of face of 65 micrometers 15g of eyes/and m<sup>2</sup> which consist of electret split fiber and 4-denier polypropylene Needle punch processing of the dry type nonwoven fabric is carried out, and it is the film split mold electret fiber layer B. It produced. Although the pressure loss of this fiber layer was very as low as 8Pa, particle removal effectiveness was very as big as 41%.

[0124] (Example 4) It is eyes 350 g/m<sup>2</sup> at the process stated in the example 2. A deodorization sheet is produced and it is ASTM to this background layer. Adhesives 4 g/m<sup>2</sup> of 50 micrometers of diameters of fiber which have the probe tuck of 950g/5mmphi at 25 degrees C appointed by D2979 After blowing and piling up the dust-removing sheet A, lightly, ordinary temperature sticking by pressure was inserted and carried out, it unified between press rollers, and the sheet was really [ dust-removing deodorization ] produced.

Although some dust-removing sheet sides of this sheet had produced fuzz, they were not what becomes a problem practically.

[0125] (Example 5) It is ASTM to the background layer of the deodorization sheet (eyes 170 g/m<sup>2</sup>) stated in the example 3. Adhesives 4 g/m<sup>2</sup> of 50 micrometers of diameters of fiber which have the probe tuck of 950g/5mmphi at 25 degrees C appointed by D2979 After blowing and piling up the dust-removing sheet B, lightly, ordinary temperature sticking by pressure was inserted and carried out, it unified between press rollers, and the sheet was really [ dust-removing deodorization ] produced. Fuzz does not almost have both sides of this sheet, and it excelled in handling nature.

[0126] By the time a pressure drop buildup when [ of 15 sorts of JIS ] dust load is carried out, until it reaches final pressure not to mention particle removal effectiveness being 39% and a high elimination factor is very loose though ventilation resistance is as low as 40Pa in respect of a property, and it is hard to carry out blinding and it reaches final pressure, they are 50 g/m<sup>2</sup>. Thing dust has been held. Moreover, in order to check the real effectiveness of this sheet more concretely, it was processed with filter transverse-plane size 200mmx180mm, a filter thickness [ of 40mm ], and a rib crest top-most-vertices spacing of 8mm in the shape of a pleat (sheet expansion area 0.36m<sup>2</sup>), and what attached and carried out unitization of the frame material for end-face immobilization further was installed in the interior of a car air-conditioner. The amount of 15 sorts of JIS dust maintenance of this unit was 17g per unit. the difference of a location -- that -- it is said that the amount of dust which flows from the open air of the filter for automobiles per year is about 10g, and it can be said for 1.7 years that it is effective.

[0127] (Example 6) After laying the dust-removing sheet C on top of the background layer of the deodorization sheet stated in the example 3, with usual needle punch equipment, by punch consistency 50 punch / inch<sup>2</sup>., needle punch processing was performed and it unified. There was almost no generating of fuzz etc. and it was good like the example 3. [ of the engine-performance side ] it should mention especially -- the addition value of the pressure loss measured by the each independent of a deodorization sheet and a film split mold electret fiber layer since the moderate air hole penetrated

by needle punch processing to this whole sheet was prepared -- small -- becoming -- more -- low voltage -- it became disadvantage.

[0128] (Example 7) When needle punch equipment was used for the deodorization sheet stated in the example 3, average puncturing area 2 and the hole of 5% of numerical apertures of 1.2mm were opened and the ventilation resistance of the obtained sheet was measured, it decreased still more sharply with 15Pa. On the other hand, when deodorant ability was measured, the toluene amount of adsorption was maintained with 33% of sheet weight. Moreover, there are also no omission of granular active carbon while in use as a filter, and it excelled in handling nature very much. furthermore -- it should mention especially -- a pressure drop buildup when [ of 15 sorts of JIS ] dust load is carried out, until it reaches final pressure -- very much -- loose -- blinding -- carrying out -- hard -- final -- 50 g/m<sup>2</sup> Thing dust has been held. That is, it can be said that the deodorization function became that low voltage loss and whose dust-removing function improved further, maintaining.

[0129] The above-mentioned result is shown in Table 2.

[0130]

[Table 2]

	シート構成		特性			
	エレクトレット繊維層	粒状活性炭含有シート	通気性シート 充填密度 (g/cc)	圧損(Pa)	0.3μm粒子 除去効率(%)	JIS 15種粉塵 保持量(g/m)
実施例4	フィルムスプリット型 エレクトレット繊維30g/m <sup>2</sup>	遠式抄紙による活性炭濾過シート (活性炭粒子径310μm品使用 目付350g/m <sup>2</sup> )	250	38	39	50
実施例5	フィルムスプリット型 エレクトレット繊維30g/m <sup>2</sup> +ポリエステル熱融着 繊維10g/m <sup>2</sup>	遠式抄紙による活性炭濾過シート (活性炭粒子径130μm品使用 目付170g/m <sup>2</sup> )	120	40	39	50
実施例6	フィルムスプリット型 エレクトレット繊維30g/m <sup>2</sup> +ポリプロピレン不織布15g/m <sup>2</sup>	遠式抄紙による活性炭濾過シート (活性炭粒子径130μm品使用 目付170g/m <sup>2</sup> )	120	33	39	56

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the mimetic diagram of the adsorbent sheet of this invention, and that in which (A) was formed only with the granular-active-carbon content sheet, and (B) have a permeability sheet and a cover factor further.

[Drawing 2] The approximate account Fig. showing the example of an equipment configuration at the time of manufacturing the adsorbent sheet of this invention by the long network type paper-making method

[Description of Notations]

1 Granular Active Carbon

2 Fiber Component (Support Fiber, Adhesive Fiber)

3 Nonwoven Fabric

4 Cover Factor

L1 Surface layer

L2 Background layer

L3 Permeability sheet

18 Humid Webb

19 Adsorbent Sheet

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[Translation done.]

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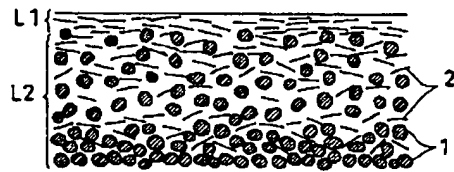
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## DRAWINGS

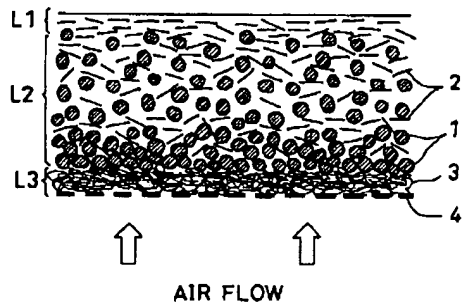
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[Drawing 1]

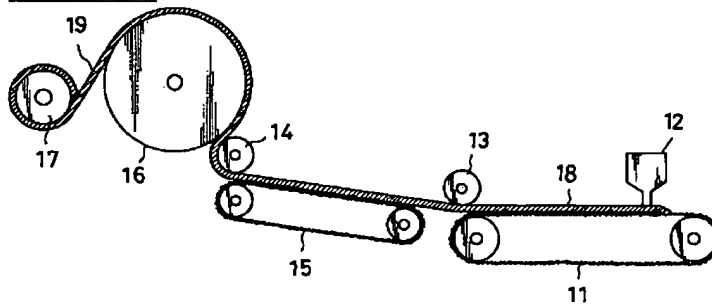
(A)



(B)



[Drawing 2]



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[Translation done.]